polarisation, and examination between crossed Nicols failed to elicit any appearance indicating strains in the glass. The spectra seemed to be identical with the colours of thin plates, with which they agree in being much brighter in reflected than in transmitted light. The colours are also complementary in the two cases, as can easily be shown by the use of a micrometer eyepiece; the colour of the band lying on a certain division being noted, the moving of a suitably arranged screen cuts off the light from the mirror under the stage and allows that from a condensing lens above the stage to fall on the glass; the colour is then seen to change into its complementary, passing through white if the two lights are of suitable relative brightness. If the surface layers of the glass near the scratch are separated somewhat from those below, the interval forms a thin plate, and this would suffice to account for the spectra, as the separation would necessarily reach a maximum at the scratch, and we there find the spectra nearest together; moreover, along the edge of the outermost spectrum, the black of the first order is quite distinct wherever the spectra are broad enough to allow their colours to be distinguished. The splitting perpendicularly to the cleavage plane would then be quite analogous to that seen in other brittle substances, and as every one must have repeatedly observed it in cutting such substances as camphor, paraffin, or ice (Fig. 4 shows the condition of the glass on this supposition). That a tendency really exists in scratched glass for the surface layers to tear up we know from the fact that splinters of glass near the scratch will often keep peeling off for days together.

3.

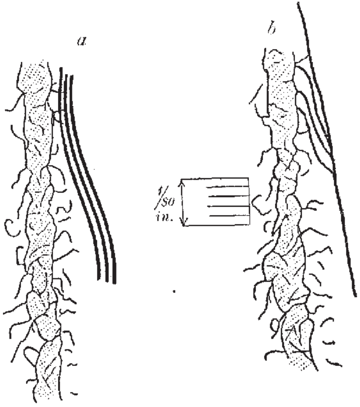

FIG. 3.

4.

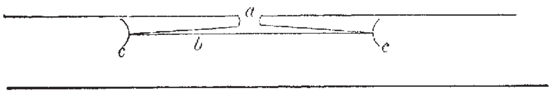

FIG. 4.—*a* = the scratch; *b* = the cleft under the torn-up surface layer; *c c* = the splits.

E. F. J. LOVE,
Demonstrator of Physics in the Mason College
Birmingham, July 14

Prof. Sylvester's Article on "A New Example of the Use of the Infinite and Imaginary in the Service of the Finite and Real"

I SHOULD like to be allowed to mention that Mr. Buchheim has drawn my attention to the fact that one of the theorems in the postscript to my recent article in NATURE contained in the formula—

$$P' : Q' = \frac{P : Q}{\sqrt{P : P}\ \sqrt{Q : Q}}$$

is virtually given under a slightly different notation in the second edition of Grassmann's "Ausdehnungslehre," p. 141.

July 12 J. J. SYLVESTER

Rainfall of N.W. England

THE rainfall on the coast-line of the Dee and the sea from Chester to Llandudno in the spring and summer months presents some interesting features. As a rule the amount of rain is the greatest at the Chester end in the spring months (April to June), and at the Llandudno end in the summer months (July to September). This is shown by the following table:—

	1882		1883		1884	
	Colwyn Bay[1] In.	Chester In.	Colwyn Bay In.	Chester In.	Colwyn Bay In.	Chester In.
April	3·01	3·59	0·68	0·79	1·32	0·92
May	1·54	2·16	1·86	1·09	1·37	0·94
June	3·39	3·95	2·15	2·94	1·15	2·06
	7·94	9·70	4·69	4·82	3·84	3·92
July	3·20	3·52	1·13	1·86	4·43	4·08
Aug.	3·47	2·52	2·19	2·64	1·35	1·05
Sept.	2·45	1·80	4·34	5·07	1·67	1·95
	9·12	7·84	7·66	8·57	7·45	7·08

That this result is not a mere coincidence will be gathered from the following statement of the rainfall last month (June, 1885) at Chester, Colwyn Bay, and Bagillt, this last being between the other two places, at a distance of fifteen miles from the former or twenty-five miles from the latter:—

June	Chester In.	Bagillt In.	Colwyn Bay In.
5	0·12	0·07	0·18
6	·38	·21	·20
7	·33	·29	·24
8	·11	·05	·01
16	·18	·15	·03
18	·10	·06	·05
19	·04	·02	·02
20	·16	·09	·03
23	·79	·46	·32
24	·13	·08	·02
29	—	·02	—
	2·34	1·50	1·10

It will be seen that on every day, except one, the rainfall was highest at Chester, Bagillt coming next, and Colwin Bay being the lowest. There must therefore be some definite law which governs this gradual decrease from east to west; and in the hope of drawing out the opinions of more skillful meteorologists on the subject, I venture to suggest the following explanation.

It is generally admitted that atmospheric currents travelling across the Atlantic from the south-west reach our islands charged with aqueous vapour almost to saturation. These, meeting the mountains of Wales and Cumberland, are driven up into a higher and colder region where the moisture is condensed into rain, causing a very heavy rainfall on the *western* slopes. Now if a line be drawn south-west from Colwin Bay, it will be found to pass over some of the highest mountains in Wales, so that *in spring*, when the air above these mountains is still cold, the moisture is so effectually condensed that there is little left to fall on the north-east side. But if a parallel line be drawn south-west from Chester it passes over no very high region, and the moisture is therefore less completely drained from the atmosphere. But, as the summer goes on, the mountain-tops become warmer and the condensation on them less complete, and then more rain is left to fall on the north-east side, *i.e.*, at Colwyn Bay. And as the *summer* day temperature is higher at Chester than Colwyn Bay, less rain is condensed at the former place.

Chester, July 18 ALFRED O. WALKER

"Foul Water"

MY attention has just been called to Mr. Shrubsole's letter under above title. Having been for several weeks past engaged in dredging off the North Wales coast, I have continuously noticed the profuse amount of gelatinous bodies diffused throughout the sea, evidently of the same character as observed by Mr. Shrubsole off Sheerness. They appeared here early in June.

The little bodies are distinctly visible on holding a bottle of sea-water up to the light. They vary in size from 1/16th to

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[1] Colwyn Bay is about five miles east of Llandudno.

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1/10th of an inch in diameter, and are spherical or oblong in form, the translucent membrane appearing under the microscope to be composed of minute particles and spicules imbedded therein.

As my observations included the examination of surface-life, the tow-net was continuously employed, and was always rapidly filled with so much gelatinous substance that it was difficult to pick out the Copepoda or other pelagic life. But although all of the bodies were perfect in form when taken in a bottle, the rush of water into the tow-net was sufficient to fracture them, the result being a mass of broken gelatinous *débris* (apparently vegetable) which clung tenaciously to the muslin of the net.

They appeared to be most numerous a few feet below the surface, and are distinctly visible on looking down into the water from the boat-side. Weather does not seem to affect them, being apparently equally prevalent on a calm or a rough day; but I noticed while rowing across from Penmaenmaur to Puffin Island, a distance of seven miles, that they were less plentiful about the middle of the entrance to the Menai Straits than nearer each side.

Early in June they were in profusion about the mouth of the Dee. Associated with them I have invariably found quantities of *Noctiluca*, which soon congregated about the surface of the collecting-jar, while the gelatinous spheres remained suspended in the water, and the *débris* from the tow-net fell to the bottom.

Any light that can be thrown upon the nature and appearance of these curious bodies will be much esteemed.

Liverpool, July 16 ISAAC C. THOMPSON

The Banner System of Drainage

OUR attention has been called to a paragraph in NATURE (p. 221) in which you review, "Hygiene, a Manual of Personal and Public Health," by A. Newsholme, M.D., Lond. In your review or criticism you state that you "do not agree with Dr. Newsholme in thinking the 'Banner system of drainage one to be recommended,'" and you say your system coincides with that of *several practical sanitarians*. Now, as this is calculated to do harm, and as our system *has* been *approved* of by the *most* eminent sanitarians, and has also obtained the highest awards at all the most important exhibitions, including a Gold Medal at the Health Exhibition, 1884, and has been successfully applied to many noblemen's mansions, hospitals, and other important public buildings, as well as to thousands of houses, we hope you will think we are justified in asking you to tell us your reasons for expressing the unfavourable opinion you have, and that you will oblige us with the names of the "practical sanitarians" you refer to.

We are unacquainted with Dr. Newsholme, and until the paragraph in NATURE was pointed out to us we were not aware of the existence of such a gentleman. Nevertheless, in fairness to him as well as to the public, we will thank you to insert this in your next issue.

BANNER BROTHERS AND CO.,
per MANAGER

11, Billiter Square, E.C., July 14

[Exception having been taken by Messrs. Banner & Co. to a statement which appeared in our last issue in the review of the Elementary Text-books of hygiene, having reference to this system, we have no objection to state that (in the opinion of our reviewer) the Banner system, although correct in principle, is unnecessarily complicated in the details of its working. The "Banner Patent Closet" shown in diagram in the book referred to is a modification of the pan-closet, a closet which has been universally condemned and as almost universally acknowledged to be incapable of improvement.—ED.]

ON THE USE OF CARBON BISULPHIDE IN PRISMS[1]

IN the *American Journal of Science* for April, 1885, there is an account of some experiments of Dr. Draper's which will be read with great interest by all who have used liquid prisms in a spectroscope. The following is an abstract of the article :—

The photographs which were taken in the research on the presence of oxygen in the sun were obtained by the use of two hollow prisms filled with carbon bisulphide. The same prisms had been used by Mr. Rutherford to produce his celebrated solar prismatic spectrum. The photographic work for the oxygen research was done in New York in a back room of the third storey of Dr. Draper's residence. The temperature of the room was remarkably uniform and the definition was all that could be desired. When, however, the research was continued in the new physical laboratory which Dr. Draper completed in 1880, it was found practically impossible to use carbon bisulphide prisms in the room owing to the rapid variations of temperature. No definition whatever could be obtained with the same prisms which had performed so well previously. In consequence the use of these prisms had to be abandoned and a series of experiments made to obtain the spectrum by other means. A Rutherford silvered glass grating of 8640 lines to the inch and a train of six flint glass prisms made by Steinheil were each tried. The grating was not found satisfactory, partly because want of light rendered long exposure necessary, partly because the definition was not so good as had been originally obtained from the bisulphide prisms. The flint prisms gave excellent definition, quite as good as had been obtained with the bisulphide prisms, but there was less light, and it was found impossible to get the line H on the photographic plate, through the train. The dispersion between G and H with the six flint prisms was not quite so great as with the two bisulphide of carbon prisms.

Among the earliest experiments which were undertaken in the new laboratory was a series made to test the performance of a bisulphide prism of Thollon's construction, made by Hilger, of London. This prisms consists of a glass bottle having two plane sides, making an angle of 90° with one another, upon which are cemented two prisms of flint glass 4 by 2 inches on the face, having each a refracting angle of 18°. The refracting edges of these glass prisms are opposed to that of the bisulphide prism. Hence the refracting angle of the compound prism is 54°. The same difficulties were experienced with this prism as with the Rutherford bisulphide prism. Owing to the temperature variations the lines were "woolly" and no definition was possible. It was found that the dispersion power of the Thollon prism was equal to that of about four of the Steinheil flint prisms; and this fact, together with the unsatisfactory character of the results obtained with the train of prisms as well as with the grating, led Dr. Draper to undertake an investigation into the cause of this unsteadiness of the bisulphide with a view to remedying it if practicable.

While using these prisms Mr. Rutherford made an important observation. He noticed that if a good prism which, with a high power, refuses to define the soda line (a more stringent test than soda lines), is violently shaken and then placed in position, it will for a few minutes define beautifully, but gradually settle to its former condition.

It occurred to Dr. Draper, therefore, that possibly the striæ caused by convection-currents produced by inequalities of temperature, and which caused the bad definition, might be destroyed by an active agitation of the liquid. He therefore placed a small propeller wheel in the bisulphide contained in the Thollon prism, passing its shaft through the stopper so that he could drive it at any desired speed by an electro-motor. The result was marvellous: by thus keeping the liquid in agitation all inequalities in its density were prevented, and the definition became excellent. Thus arranged, the Thollon prism was found to be superior, especially in quantity of light, to the Steinheil train of prisms.

Now another source of error was developed. Although when the propeller was running the definition of the bisulphide was not affected by changes of temperature, yet now these changes of temperature, by changing the refractive index of the liquid, caused a continual shifting of

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[1] Being an account of experiments made by the late Dr. Henry Draper, of New York.

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